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1.0 INTRODUCTION

LDS-Akron has developed a 3D Laser Radar Vision Processor system capable of detecting, classifying, and identifying small mobile targets as well as larger fixed targets using 3-dimensional laser radar imagery for use with a robotic type system. This processor system is designed to interface with NASA Johnson Space Center in-house EVA Retriever robot program and provide to it needed information so it can fetch and grasp targets in a space-type scenario.

2.0 HARDWARE DESCRIPTION

The 3D Laser Radar Vision Processor system is an IBM-XT compatible computer with an INMOS board containing four transputers inserted in one of the IBM-XT expansion slots. This hardware is illustrated in Figure 1. The logical connection of the hardware is shown in Figure 2.

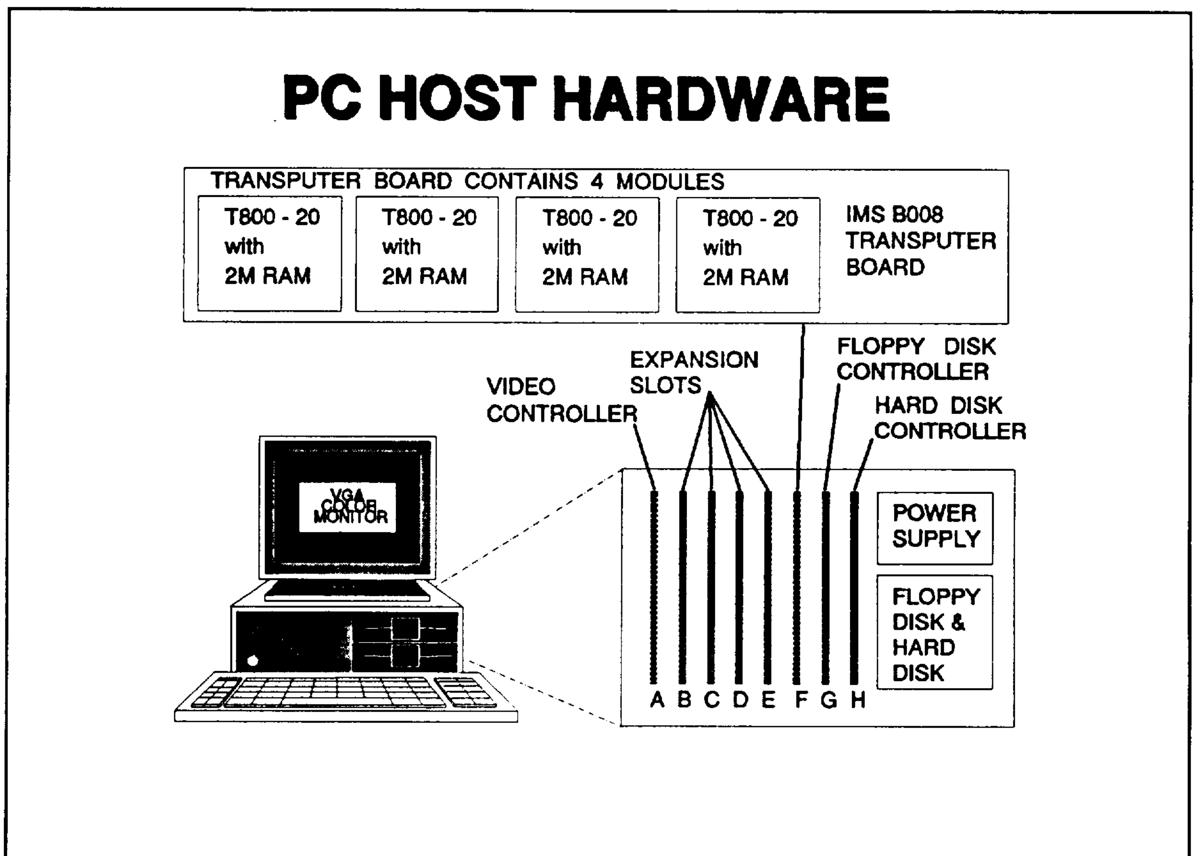

Figure 1. PC Host Computer

The delivered hardware consists of the following items:

1. IBM-XT compatible computer
2. Transputer add-in board for the IBM-XT
3. VGA monitor and card

The computer system is an IBM-XT compatible computer which serves as a stand-alone development system for the 3D Laser Radar Vision Processor. This computer includes the following: a 10Mhz XT motherboard, 40 MBytes hard disk, one 360K floppy, case, 150W power supply, keyboard, VGA monitor, and VGA display card.

The heart of the Loral's 3D Laser Radar Vision Processor is an IMSB008 Transputer board populated with four IMSB404 modules. The IMSB008 Transputer board is an add-in board for the IBM PC, which takes up one slot in the PC and provides support for up to ten INMOS Transputer modules. This support includes a communication link between the XT and the transputer's network and the interconnection network between the transputers. The transputer interconnection network is provided by an on-board IMS C004 link switch. The IMS C004 allows the user to specify transputer interconnections without doing any physical wiring. Controlling the IMS C004 is an on-board T212 processor.

The transputer module that will be used with the IMSB008 Transputer board is the IMS404 module. The IMS404 module contains one 20 MHz INMOS T800 Transputer along with 2 MBytes of dynamic RAM memory. The T800 transputer is a 32-bit floating point RISC processor. An integral part of the T800 Transputer is its ability to communicate with up to four other transputers via high speed (2.35 MBytes) serial link.

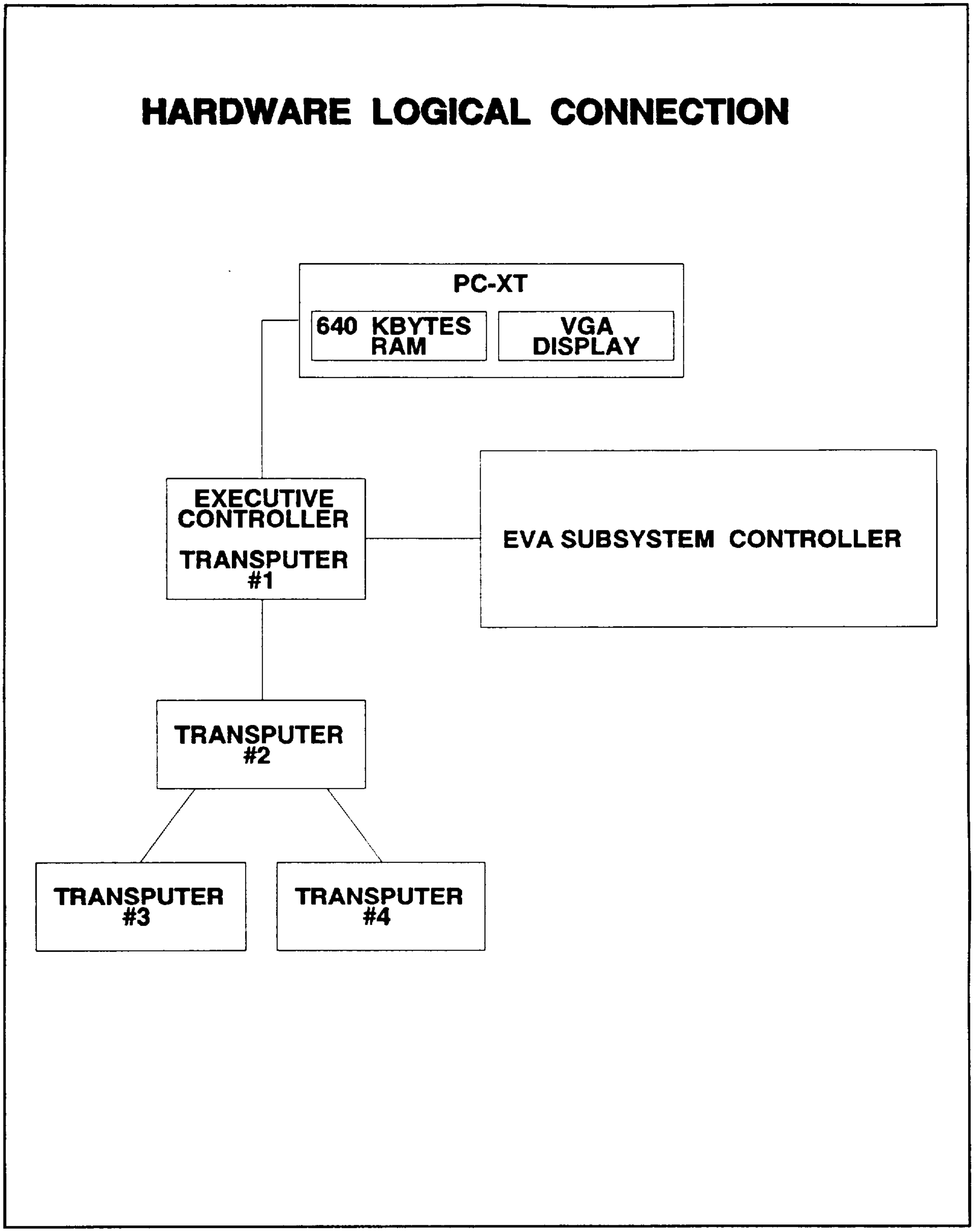

Figure 2. Hardware Logical Connection

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"AIRBORNE MEASUREMENTS OF DMS AND SO_2 DURING GTE/CITE-3"

NASA RESEARCH GRANT NAG 1-925

FINAL REPORT
TO
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FROM
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FOR THE PERIOD FEBRUARY 1, 1989 THROUGH JANUARY 31, 1991

(NASA-CR-193750) AIRBORNE MEASUREMENTS OF DMS AND SO2 DURING GTE/CITE-3 Final Report, 1 Feb. 1989 - 31 Jan. 1991 (Washington Univ.) 4 p

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FINAL REPORT FROM THE
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The first period of the grant involved preparation for the field study, initially for one month at Wallops Island, Virginia (between August 2 and September 7, 1989) and then for the three weeks near Natal, Brazil (between September 7 and September 29, 1989).

The second period involved participation in the field phase of the project, data collection, sample analysis, and reporting of the intercomparison data to the CITE-3 data manager.

The third period included:

- Data interpretation for the intercomparison species (DMS and SO_2),
- Quality assurance checks and submission of final intercomparison data to the CITE-3 data archive,
- Participation in the CITE-3 data workshop (May 21–24, 1990) at Arlington, VA, and
- Laboratory work to determine the nature of high field blanks encountered for the SO_2 filters. Several improved filter preparation techniques were identified.

During the fourth and final period the following tasks were completed:

- Presentation of a poster at the Fall AGU meeting covering the analytical aspects of our DMS and SO_2 techniques.
- Participation in NSF/NASA Workshop on Verification of Analytical Methodology for Tropospheric Sulfur-Containing Gases.
- Preparation of a publication on our results from CITE-3 to be included in the JGR special issue (will be submitted by March 31, 1991).

Highlights of our results are:

DMS:

- Our DMS technique (preconcentration on gold wool preceded by a KOH-impregnated filter for scrubbing oxidants) proved to be accurate and effective for all conditions encountered during CITE-3. Our measurements of DMS proved to be the most accurate relative to NIST standards (ratio = 1.01 ± 13% (1σ), n = 9) of the 6 techniques tested. Precision of ± 13% was bit higher than experienced later in the project due to the initial higher noise of the GC/FPD system when first assembled at Wallops. After several days of operation, the 1σ uncertainty for standards was reduced to ± 9%.
- For field measurements, our DMS measurements correlated best with the average of all 6 techniques (slope = 1.00 ± 0.02, intercept –2.3 ± 0.9, r = 0.99).
- Because of its light weight, low power requirements, simplicity, accuracy and ability to collect samples in as little as 2 minutes at typical marine boundary layer concentrations, our DMS technique is ideally suited to aircraft sampling.

SO_2

- Our SO_2 technique (collection on K_2CO_3/glycerol-impregnated filters) performed fairly well but was hampered by rather large blank variability. This variability is believed to be largely due to uneven leaching of sulfate (or sulfite) from the Whatman 54 paper substrate.
- Even so, relative to NIST standards, our carbonate-impregnated filters proved to be the most accurate of the five SO_2 techniques tested (ratio = 0.99 ± 3%, n = 3).
- During field sampling, large disagreements between all five SO_2 techniques made correlations poor between any one technique with the average value of all five techniques.
- Individual sample uncertainty, calculated as ± 2σ of the blank variability, averaged ± 34 pptv for our field SO_2 measurements. This was somewhat higher blank variability than we normally encounter and may have been exacerbated during CITE-3 by the long times between filter preparation (which was carried out at the University of Washington – UW), shipment to the field, and shipment back to the UW for analysis.
- We have since developed new cleaning procedures for the filters and a new chromatographic technique. These have resulted in a 75% reduction in the magnitude of the filter blanks, a 90% reduction in the blank uncertainty, and a four-fold increase in the signal-to-noise ratio of the chromatographic analysis. Overall,

for typical ambient samples of about 4 m^3, these improvements have reduced the 2σ blank uncertainty to approximately ± 4 pptv.

- We have determined the collection efficiency of the filters to be at least 98% for field samples. This result, coupled with the improved procedures mentioned above, makes our carbonate-impregnated filter technique a simple, cheap and viable method for aircraft sampling of marine background SO_2 in 10–20 minutes at 200 lpm.

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2/14/91